exposure is less than 1° in R.A. and less than $1\frac{1}{4}$° in Decl., an area as nearly as possible of 1°; while in the one taken with the portrait camera it covers an area of at least 6°.

The photograph must speak for itself, but there is one feature of special interest. Herschel's lemniscate—at least the greater part of it—seems quite black to the eye aided by large telescopes, and the same in the photograph with the star camera, but it will be seen that in the one with the portrait camera it is not without nebulous light, and the prolonged exposure has brought it out sufficiently to fill up the dark space completely, while the dark oval which Herschel describes so carefully at R.A. − 100 and Decl. + 900 of his drawing is in the photograph absolutely dark, and thrown into great prominence by the brilliance of the nebulous light around it. I have also sent two enlargements of portions of the Moon, one showing *Copernicus* nearly 1 inch in diameter (scale for whole Moon 34 ins.), with corresponding detail inside and outside the crater; this is from a negative taken direct, $5\frac{1}{2}$ ins. in diameter: also a portion of the Apennine mountains, on a scale of 65 ins. = diameter of the Moon. The negative for this was taken direct on a scale of 20 ins. to diameter of Moon. Both these Moon pictures contain more detail than any I have seen; the latter especially brings the precipices, clefts, and valleys of the Apennines into striking prominence, on a scale which makes *Archimedes* $1\frac{3}{4}$ in. in diameter.

Sydney Observatory:
1892 *September* 17.

The Motion of ζ Cancri. By S. W. Burnham, M.A.

In a paper entitled "Invisible Double Stars" (*Monthly Notices*, April, 1891) I gave the result of an investigation of the observed positions of the star C of this system. From this it appeared that, while the observed places of this star were apparently arranged in somewhat regular groups, all of the stars of the same class which were examined showed the same tendency, and with about the same regularity. The question to be solved was whether this apparent want of uniformity in the motion of the star was to be ascribed to the disturbance produced by some unknown and invisible body, or to the ordinary errors of observation. While there is nothing, perhaps, improbable in the theory that non-luminous stars may exist throughout space, and may be components of binary systems, still it is at present a speculation at best, and it is obvious that it should be adopted as an explanation of actual observations only when the ordinary ways of accounting for apparent discordances have been positively shown to be insufficient. There would be less room for debate if *ζ Cancri* were the only example of this kind, but I have shown that in other stars, selected at random from those having an angular movement around their primaries of about the same

amount, all show without exception the same apparently variable motion, more or less prominently. This suggests the possibility, at least, that the explanation may be found in the errors of observation. Otherwise we are forced to admit the existence of many more "dark suns" than one could reasonably expect to find in a single class of binary stars.

I also suggested that the best way to determine this interesting question in the case of *ζ Cancri* would be to measure C from some outside star, entirely disconnected from the triple system. By keeping up regularly for a few years a careful system of measures, it could doubtless be shown whether or not the motion of C was uniform. It seemed to me that measures of the difference of the declinations of C and some convenient star in the vicinity would be most likely to avoid the errors which to some extent would certainly be found in measures connecting C with the close pair, A B; and I called attention to a $7\frac{1}{2}$ *m* star (Lalande 12262) about 2^m following *ζ Cancri*, and $1'\cdot5$ north, as being suitable for this comparison and also to a 9 *m* D M. star nearly following, which could be used for angular measures only. Obviously measures of the difference of declination are superior to any other for determining change. With the telescope stationary the bisections can be made with an accuracy not attainable in direct measures of considerable distances. In this case the sole question to be determined, in the first instance, is whether any change in the relative positions of these two stars in declination is uniform. Change due to the proper motion of either star, or to the orbital movement of C about the close pair, can, of course, be wholly neglected, since that will be a constant quantity.

In the interest of the solution of this question I have put these suggestions in practice, and have made each year a careful set of measures of C, with reference to the star which follows, for the difference in declination; of C from A and B as separate stars; and of the angular direction of the small star, D M. (18°) 1870. The aperture in inches of the telescope employed is given in the last column.

C. *and* Ll. 12262.

1891·225	Diff. Decl.	103″·89	...	36
·227		101·05	...	36
·236		104·08	...	12
·241		103·99	...	36
			h m	
1892·057		103·80	Sid^l. Time 7 35	36
·085		103·72	8 00	36
·118		103·97	8 25	36
·153		103·99	8 00	36
·156		103·87	8 15	36

C. *and* D.M. (18°) 1870.

1891·181	Pos. Angle 108°·17	...	12
·208	108·33	...	12
·214	108·14	...	12
·222	108·32	...	12
·225	108·28	...	36
·227	108·15	...	36
·239	108·31	...	36
·241	108·17	...	36
1892·057	107·90	Sidl. Time 7h 30m	36
·156	108·25	8 00	36
·173	108·50	6 25	36
·186	108·35	8 10	36

A. *and* C.

1891·181	117°·6	5″·45	12
·214	117·2	5·49	12
·222	115·9	5·42	12
·225	117·3	5·57	36
·227	116·2	5·58	36
·239	115·5	5·52	36
1892·057	115·3	5·51	36
·153	116·5	5·41	36
·156	117·7	5·42	36
·186	117·3	5·58	36

B. *and* C.

1891·181	128°·1	5″·52	12
·214	127·6	5·66	12
·222	128·5	5·56	12
·225	127·4	5·58	36
·227	127·7	5·61	36
·239	127·3	5·69	36
1892·057	127·4	5·66	36
·153	128·3	5·48	36
·156	127·6	5·52	36
·186	127·5	5·46	36

A. *and* B.

1892·153	32°·7	1″·04	36
·186	33·2	1·02	36
1892·17	33·0	1·03	

The mean results of the two sets of measures are as follows:—

C. *and* Ll. 12262.

1891·23	Diff. Decl. 104″·00	4*n*
1892·11	103·87	5*n*

C. *and* D.M. (18°) 1870.

1891·22	Pos. Angle 108°·23	8*n*
1892·14	108·00	4*n*

A. *and* C.

1891·22	116°·6	5″·50	6*n*
1892·14	116·7	5·48	4*n*

B. *and* C.

1891·22	127°·8	5″·60	6*n*
1892·14	127·7	5·53	4*n*

All of the measures were made near the meridian, and under favourable atmospheric conditions. I have not noted the sidereal time in the first observations of the distant stars, but the slight change due to refraction is of no practical consequence, and in any event it is essentially the same for all the observations. In the measures of C from the components of the close pair, high powers were always used, and A and B were widely separated; at the same time it is not easy, and perhaps impossible, to prevent the presence of a third star, within 1″ of that which is being measured, from having some effect in the placing of the wires both in angle and distance. I rely principally upon the measures of declination. It will be well, however, to continue all the measures of the stars used here; but I think it is important that the aperture and power used should be sufficient to observe the components of the close pair separately. I do not think measures of C from A B as one star would have much value in determining whether or not the movement of the first-named star is variable.

Doubtless other observers who have taken an interest in this question of an invisible disturbing body have already commenced observations similar to those given here. I trust that this is so, and that they will be systematically continued until sufficient data are obtained to settle the point definitely by the best evidence of all.

Chicago: 1892 *October* 17.

On the Orbit of Σ 2525. By J. E. Gore.

A recent measure of this binary star made by Mr. Burnham with the 36-inch refractor of the Lick Observatory shows that the companion has described about 288° of its apparent ellipse since its discovery by Struve in 1830. I have computed the orbit by the Glasenapp-Kowalsky method, and find the following provisional elements:—

Elements of Σ 2525.

$P = 138{\cdot}54$ years.	$\Omega = 78^\circ\ 19'{\cdot}5$
$T = 1887{\cdot}12$	$\lambda = 4^\circ\ 19'$
$e = 0{\cdot}802$	$a = 0''{\cdot}75$
$i = 54^\circ\ 0'$	$\mu = -2^\circ{\cdot}5984$

The following is a comparison between the measures used in calculating the orbit and the positions computed from the above elements. Some of the measures are rather discordant.

Epoch.	Observer.	θ_o	θ_c	$\theta_o - \theta_c$	ρ_o	ρ_c	$\rho_o - \rho_c$
		°	°	°	"	"	"
1830·43	Struve	255·9	257·3	−1·4	1·33	1·32	+0·01
1836·14	,,	255·5	255·5	0·0	1·30	1·28	+0·02
1840·56	O. Struve	251·8	254·1	−2·3	1·04	1·24	−0·20
1840·62	Dawes	255·5	254·1	+1·4	1·25	1·24	+0·01
1840·70	O. Struve	252·4	254·1	−1·7	1·28	1·24	+0·04
1840·84	,,	253·1	254·0	−0·9	1·52	1·24	+0·28
1842·41	Mädler	251·0	253·5	−2·5	0·82	1·21	−0·39
1843·69	,,	254·0	253·1	+0·9	0·95	1·20	−0·25
1854·63	O. Struve	246.8	248·5	−1·7	1·05	1·05	0·0
1856·61	Secchi	247·1	247·7	−0·6	0·85	1·01	−0·16
1865·22	Dembowski	240·8	242·3	−1·5	0·60	0·81	−0·21
1865·48	Engelmann	253·6	242·2	(+11·4)	0·73	0·80	−0·07
1865·64	Secchi	239·9	242·1	−2·2	0·40	0·80	−0·40
1865·76	O. Struve	241·5	242·0	−0·5	0·74	0·80	−0·06
1865·80	,,	242·4	242·0	+0·4	0·73	0·80	−0·07
1872·61	,,	234·0	234·8	−0·8	0·66	0·60	+0·06